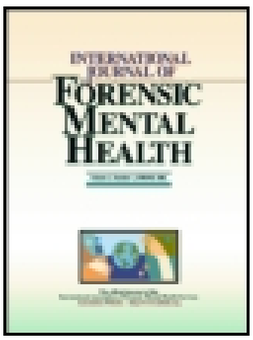

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Individuals with Psychopathic Traits view Distracting Neutral Information as Negatively Valenced

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ABSTRACT

Research has shown that psychopathic individuals ignore information that is outside their goal-directed focus of attention. When affective information is goal-irrelevant, ignoring it results in a blunted affective response for psychopathic individuals. In cognitive science, though, an interesting phenomenon named inhibitory devaluation occurs in the context of neutral information. When neutral information is not relevant to a goal, ignoring it actually results in individuals' evaluating the neutral information as negatively valenced. In a sample of adult male offenders ($N = 82$), we used a pattern localizer task to examine the relationship between inhibitory devaluation and psychopathy (using scores on the Psychopathy Checklist-Revised). Results indicated that individuals high on the interpersonal-affective traits of psychopathy displayed significantly greater inhibitory devaluation, meaning that they ascribed more affective valence to goal-irrelevant neutral information. This finding provides further support for the importance of attention abnormalities in the neurobiology of psychopathy-related affective and interpersonal deficits.

KEYWORDS

Psychopathy; interpersonal-affective traits; inhibitory devaluation; attention; neutral

Psychopathic individuals are characterized by shallow affect, callousness, impulsivity, and chronic antisocial behavior. Historically, these characteristics are attributed to a core deficit in affective responding (Lykken, 1957; Patrick, 2007). More recent research, however, shows that individuals with psychopathy do not demonstrate pan-situational deficits in affective responding, but instead exhibit abnormal selective attention that limits the processing of information that is outside their primary focus of attention, including affective cues (Baskin-Sommers, Curtin, & Newman, 2011, 2013; Newman & Lorenz, 2003). This fixation on goal-relevant information is thought to allow psychopathic individuals to ignore others' emotions and harm others to achieve their goals (e.g., respect, money, etc.), while simultaneously allowing them to respond normatively to affective information when such information is goal-relevant, facilitating their ability to con or manipulate others. Although this type of goal-fixation may be highly beneficial for the obtainment of short-term goals, it also impairs an individual's ability to process highly important, peripheral information related to the potential negative consequences of their actions (e.g., incarceration, hurting others; Baskin-Sommers, Stuppy-Sullivan, & Buckholtz, 2016).

Psychopathy-related abnormalities in the allocation of selective attention have been demonstrated across multiple paradigms. For example, in experimental contexts (e.g., instructed fear conditioning, passive-avoidance learning, counterfactual reasoning) where affective information is goal-relevant psychopathic individuals show normative, and even sometimes exaggerated, affective responses (Baskin-Sommers et al., 2016; Flor, Birbaumer, Hermann, Ziegler, & Patrick, 2002; Newman & Kosson, 1986; Tillem et al., 2016). However, their reaction to the same affective information is deficient when their attention is allocated to an alternative goal (Baskin-Sommers et al., 2011, 2011, 2013; Larson et al., 2013; Sadeh & Verona, 2012). Psychopathic individuals show similar attention abnormalities when processing affectively neutral information. During affectively neutral attention tasks (e.g., flanker, modified Stroop, attention blink) which require participants to attend to goal-relevant stimuli, while ignoring peripheral cues, psychopathic individuals show enhanced performance (i.e., less interference from peripheral information) indicating greater attention to goal-relevant information, and less attention to peripheral, goal-irrelevant cues (Hiatt, Schmitt, & Newman, 2004; Hoppenbrouwers, Van der Stigchel, Slotboom, Dalmaijer, & Theeuwes, 2015; Wolf et al., 2012; Zeier, Maxwell, & Newman, 2009). Thus, psychopathic individuals are capable of responding to information, whether affective or non-affective, when it is a primary focus of their

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attention. However, because of their limited ability to attend to and process contextual information during goal pursuit, they appear oblivious to both affective and non-affective information when that information is peripheral to their goal.

In most experimental contexts and across individuals, when affective information is peripheral to a goal, ignoring that information will result in a reduced response to that peripheral affective content (e.g., reduced amygdala response when ignoring distracting affective content; see Ochsner & Gross, 2005 for a review). For psychopathic individuals, this effect is enhanced compared to non-psychopathic individuals (e.g., Baskin-Sommers et al., 2011, 2013; Larson et al., 2013; Sadeh & Verona, 2012). When neutral information is peripheral to a goal, ignoring that neutral peripheral information will result in less behavioral interference. Again, for psychopathic individuals, this effect is enhanced compared to non-psychopathic individuals (e.g., Hiatt et al., 2004; Hoppenbrouwers et al., 2015; Wolf et al., 2012; Zeier et al., 2009). However, while ignoring neutral information may result in less behavioral interference, an interesting effect on affective reactivity exists when neutral information is ignored: the process of ignoring that neutral information actually evokes a negative affective response to that previously presented neutral information (Mohanty & Sussman, 2013; Doallo et al., 2012; Fenske & Raymond, 2006; Kiss et al., 2007; Raymond, Fenske, & Tavassoli, 2003). Given the prior research that shows psychopathic individuals limit attention to peripheral information to a greater degree than non-psychopathic individuals (in both affective and non-affective contexts), it may be that they will have an exaggeration of this effect, resulting in a greater negative affective response to neutral, peripheral stimuli.

Research within non-clinical populations has found that affectively neutral information is not always viewed as neutral, but may be interpreted as affectively valenced depending upon the manner in which the neutral information is presented (Mohanty & Sussman, 2013; Fenske & Raymond, 2006; Klauer, 1997; Raymond et al., 2003). This affective attribution is most reliably demonstrated in two phenomena: inhibitory devaluation (Fenske & Raymond, 2006; Raymond et al., 2003) and affective priming (Klauer, 1997). Inhibitory devaluation is defined as the negative evaluation of previously ignored, peripheral stimuli, even when those peripheral stimuli are affectively neutral (see Mohanty & Sussman, 2013 and Fenske & Raymond, 2006 for reviews). For example, inhibitory devaluation has been observed during a go/no go task where participants were instructed to respond to all neutral Asian faces and ignore all neutral Caucasian faces. During this task, limiting attention to neutral Caucasian faces evoked negative affect. Then, in subsequent exposures, those faces were evaluated as unpleasant or untrustworthy regardless of whether the neutral Caucasian faces were primary or peripheral to a goal (Doallo et al., 2012; Fenske, Raymond, Kessler, Westoby, & Tipper, 2005; Fenske, Raymond, & Kunar, 2004; Frischen, Ferry, Burt, Pistchik, & Fenske, 2012; Raymond, Fenske, & Westoby, 2005). Thus, inhibitory devaluation consists of multiple parts, first the individual limits attention to peripheral information, this limiting of attention then evokes negative affect (De Vito, Al-Aidroos, & Fenske, 2017; Doallo et al., 2012; Kiss, Raymond, Westoby, Nobre, & Eimer, 2008; Kiss et al., 2007), this negative affect is then ascribed to the peripheral information resulting in its devaluation, and finally that information remains devalued in future exposures, even if the information is no longer peripheral (Fenske et al., 2004; 2005; Frischen, Ferrey, Burt, Pistchik, & Fenske, 2012; Martiny-Huenger, Gollwitzer, & Oettingen, 2014; Raymond et al., 2003, 2005).

In contrast to inhibitory devaluation, affective priming occurs largely independently of an individual's allocation of selective attention. Affective priming is when an implicit evaluation of an affective prime leads to subsequent stimuli being viewed as the same valence as that prime. This phenomenon is observed when an individual is exposed to an affectively valenced, task-irrelevant, priming stimulus prior to judging his/her affective response to a different, task-relevant, neutral stimulus (Klauer, 1997). Even though the individual may not be deliberately attending to the prime, their initial exposure to the affective stimulus "primes" that individual to view the subsequent neutral stimulus with the same affective valence as the prime. For example, if an individual was primed with a picture of a sad face, and then was asked to rate their response to a particular type of food, the sad face prime would increase the likelihood that individual would rate the food more negatively. This affective priming effect would occur even if the individual was not explicitly instructed to attend to the sad face, or even if the individual was not consciously aware that a sad face had been presented (Sweeny, Grabowecky, Suzuki, & Paller, 2009).

The goal of the present study was to examine how psychopathic individuals respond to affectively neutral stimuli within a paradigm that manipulates both inhibitory devaluation and affective priming. Inhibitory devaluation and affective priming are two independent means of manipulating how affectively neutral stimuli are perceived (Raymond et al., 2003). Since the effects of affective priming can occur regardless of attentional focus, psychopathy should not be significantly related to the effect of affective priming during this task. Conversely, since inhibitory devaluation occurs as a result of limiting

attention to peripheral stimuli, and psychopathic individuals tend to ignore peripheral information to a greater degree than non-psychopathic individuals, psychopathic individuals should display significantly elevated inhibitory devaluation during this paradigm. Moreover, given the evidence that subcomponent factors of psychopathy can be associated differentially with specific neurobiological dysfunctions (Patrick, 2007) analyses were included to examine the impact of the interpersonal-affective (Factor 1) and impulsive-antisocial (Factor 2) traits on the processing of affectively neutral stimuli. Furthermore, given the growing evidence that Factor 1 traits are linked to the attention abnormalities associated with psychopathy (Anderson et al., 2017; Tillem et al., 2016; Vaidyanathan, Hall, Patrick, & Bernat, 2011), we expected to see a similar enhancement of inhibitory devaluation in individuals high on the interpersonal-affective traits of psychopathy.

Methods

Participants

Participants were 82 male individuals (56.1% African-American, 36.6% Caucasian, 8.2% Other) from a high security correctional institution in Connecticut ($M = 35.60$ years old, $SD = 10.27$). Prior to recruitment, study personnel received an institutional roster of inmates. Study personnel used this roster to prescreen institutional files in order to exclude individuals who: were not between the ages of 18 and 75, had diagnoses of schizophrenia, bipolar disorder, psychosis not otherwise specified, were currently taking psychotropic medication, or had a history of medical problems that could have impacted their comprehension of the study materials (e.g., uncorrectable auditory or visual deficits, head injury with loss of consciousness greater than 30 min). Individuals were selected randomly from a list of all eligible inmates and were provided with written informed consent according to the procedures set forth by the Yale University Human Investigation Committee. Individuals had no contact with study personnel prior to consent and received no compensation for completing the study. Following consent, participants completed an interview that included a life history assessment (see below for Psychopathy Checklist-Revised) and neuropsychological assessments. Participants who scored below 70 on a brief measure of IQ (Shipley Institute of Living Scale; Zachary, 1986), performed below the fourth-grade level on a standardized measure of reading (Wide Range Achievement Test-III; Wilkinson, 1993), or demonstrated neuropsychiatric deficits were excluded from continuing the study (see Table 1 for sample characteristics and zero-order correlations among key study variables).

Table 1. Sample characteristics and zero-order correlations (n = 82).

						Correlations											
Variable	N	Mean	Std. Dev.	Min	Max	1	2	3	4[a]	5	6	7[b]	8	9	10	11	12
Demographics																	
1. Age	82	35.60	10.27	21.00	58.00	—	.11	.11	−.04	.15	.26*	.02	.01	.16	.17	.01	−.43**
2. Shipley	82	105.00	10.89	75.00	126.00		—	.76**	−.53**	−.06	.09	−.19	.35**	−.41**	.06	−.04	.11
3. WRAT-III	82	45.57	5.56	34.00	57.00			—	−.36**	−.03	.09	−.17	.16	−.21	−.01	.09	.13
4. Race[a]	82								—	.16	.20	.14	−.04	.19	.12	.18	.07
White	30																
Black	46																
Other	6																
Individual Differences																	
5. PCL-R Total	82	24.47	6.92	5.30	37.00					—	.83**	.88**	−.05	.00	−.25*	−.18	−.27*
6. Factor 1	82	9.24	3.48	2.00	16.00						—	.51**	.05	−.08	−.18	−.17	−.25*
7. Factor 2[b]	80	12.77	3.92	1.10	20.00							—	−.08	.04	−.25*	−.16	−.22*
Task Variables																	
8. Accuracy	82	.96	.08	.64	1.00								—	−.58**	.02	−.04	−.04
9. Target Reaction Time	82	.71	.33	.27	2.18									—	−.06	.48**	−.06
10. Mean Rating	82	3.22	.73	1.00	4.98										—	.12	.28*
11. Rating Reaction Time	82	1.74	.67	.55	3.68											—	.39**
12. Rating Variability	82	.64	.42	0.00	1.72												—

Note. Shipley = Shipley Institute of Living Scale estimated full-scale IQ; WRAT-III = Wide Range Achievement Test-III; PCL-R Total Score = Psychopathy Checklist-Revised Total Score; Factor 1 = Psychopathy Checklist—Revised Factor 1; Factor 2 = Psychopathy Checklist—Revised Factor 2 Score; Accuracy = Ratio of Correct Target Responses/Number of Trials across all trials (regardless of block or condition); Target Reaction Time = Average reaction time to targets across all trials (regardless of block or condition) in seconds; Mean Rating = Average affective rating of the third pattern across all trials (regardless of block or condition); Rating Reaction Time = Average time taken rating the third pattern across all trials (regardless of block or condition) in seconds; Rating Variability = Std. Deviation of affective ratings across all trials (regardless of block or condition).

*$p < .05$

**$p < .01$

[a]Spearman correlations were used to examine the effect of race.

[b]Factor 2 scores were not able to be calculated for two participants due to omitted Factor 2 items.

Measures

Psychopathy Checklist-Revised (PCL-R; Hare, 2003). All participants were evaluated for psychopathy using the PCL-R. The PCL-R was administered in a private room by trained graduate students seeking their Ph.D. in clinical psychology, or trained study personnel with a Ph.D. in clinical psychology. This measure uses information gathered from institutional records and an interview to rate individuals on the presence of 20 different traits. Each trait was scored on a scale ranging from 0–2 depending upon the degree to which that trait was present in the individual. Accordingly, total scores can range from 0–40. The PCL-R also can be divided into a replicable two-factor structure with Factor 1 items assessing interpersonal-affective traits (e.g., glibness, shallow affect, callous) and Factor 2 items relating to impulsive-antisocial behavior (e.g., irresponsible, impulsivity, criminality). The reliability and validity of the PCL-R and its factors are well established (see Hare, 2003). In the current study, PCL-R ratings of two raters were available for 34 participants. Inter-rater reliability for PCL-R total scores, PCL-R Factor 1scores, and PCL-R Factor 2 scores are .99, 1.00, and .99, respectively.

Experimental task

Participants completed a modified version of Raymond et al.'s (2003) pattern localizer task in a private room. At the start of each trial, participants were primed with an image, a happy face, sad face, or scrambled face for 200 ms. Following the prime, the screen went blank for 50 ms, and then a Target pattern and Distractor pattern appeared on the left and right sides of the screen for 100 ms. Following the Target presentation, the screen went blank again. Participants then completed the pattern localization component of the task by indicating, via button press, which side of the screen the Target pattern appeared on. Following the participant's response, a question mark appeared in the center of the screen for 1000 ms. This question mark was then replaced by a third pattern that appeared in the center of the screen for 500 ms. Finally, the third pattern was replaced by a rating bar where the participants provided an affective rating for the third pattern. Ratings ranged from 1–5, with 1 indicating that the participant found the third pattern "definitely unpleasant" and 5 indicating that the participant found the third pattern "definitely pleasant" (see Figure 1 for task schematic).

Participants completed four blocks of this task. First, two Baseline blocks (30 trials each) and then, two Experimental blocks (60 trials each). The sequence of the Baseline blocks and Experimental blocks was counterbalanced across participants within race. At the start of each block, participants were provided with a 30s break during which they were informed which type of pattern would be the Target pattern for that block (i.e., which type of pattern they would be attending to during the block). During the Baseline blocks, the Distractor pattern and Target pattern were either monochromatic scribble patterns or monochromatic polygon patterns, while the third patterns (i.e., the patterns that were rated by the participant) were either polychromatic circle patterns or polychromatic square patterns. For these Baseline blocks, the third patterns were always incongruent with (i.e., unrelated to) both the Target and Distractor patterns. For the Experimental blocks, polychromatic circle patterns or polychromatic square patterns were used for Targets, Distractors, and third patterns. This allowed the third pattern to be congruent with (or match) either the Target pattern (Target-Congruent; 30 trials per Experimental block) or the Distractor pattern (Distractor-Congruent; 30 trials per Experimental block). Across these blocks, trials were broken down into three different trial types based on which pattern was the focus of attention for that trial: (1) Baseline trials, where the third pattern was irrelevant to the pattern localization aspect of the task; (2) Target-Congruent trials, where the third pattern was similar to the Target pattern; and (3) Distractor-Congruent trials, where the third pattern was similar to the Distractor pattern.

Data analysis

Analyses were conducted in three stages. First, to examine the basic task effects, we entered affective ratings from the four task blocks into a general linear model (GLM) with Prime (3: Happy, Scrambled, Sad) and Attention (3: Baseline, Target-Congruent, Distractor-Congruent) as within-subject categorical factors. Given that inhibitory devaluation is commonly examined by contrasting ratings of previously peripheral stimuli against either previous targets, or task-irrelevant stimuli, planned simple contrasts of Distractor-Congruent vs. Target-Congruent, and Distractor-Congruent vs. Baseline were the analytic focus for the Attention factor. Second, to examine the effects of psychopathy on priming and inhibitory devaluation a three (Affect) by three (Attention) GLM was run with PCL-R total score (z-scored) entered as a between-subject continuous factor. Again, following previous research, planned simple contrasts were used to examine the Attention factor. Finally, another three (Affect) by three (Attention) GLM was run with PCL-R Factor 1 and PCL-R Factor 2 scores (z-scored) entered simultaneously into the GLM as continuous between-subject factors. To protect against

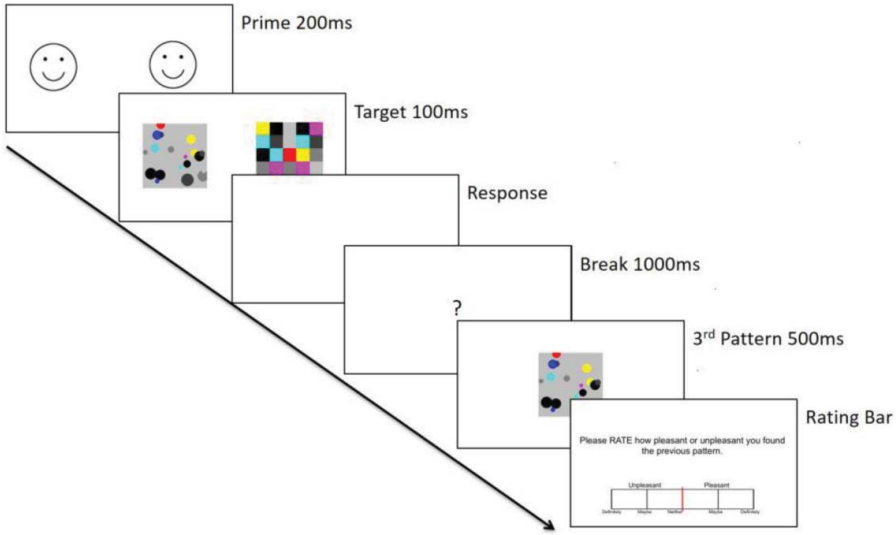

Figure 1. Trial schematic for the modified version of Raymond et al.'s (2003) pattern localizer task. Participants were presented with one of three primes, followed by a blank screen. The blank screen was then replaced with two patterns, one target pattern and one distractor pattern. Participants then indicated which side of the screen the target pattern appeared on. Following their response, participants were then presented with a question mark, followed by a third pattern. Participants were then asked to rate the third pattern on a scale of one to five, with one indicating they found the third pattern "Definitely Unpleasant" and five indicating that they found the third pattern "Definitely Pleasant."

violations of the assumption of sphericity, Huynh-Feldt corrected p values are reported.

Results

Manipulation check

The Distractor-Congruent vs. Target-Congruent contrast was significant, $F(1,81) = 7.047$, $p = 0.01$, $\eta p2 = 0.080$, where individuals rated distractors as significantly less pleasant than targets. This indicates that the attention manipulation for this paradigm was successful and suggests that, as a whole, this incarcerated sample displays inhibitory devaluation of previously ignored stimuli. The main effect of Prime was not significant, $F(2,162) = 2.218$, $p = 0.116$. Also neither the Distractor-Congruent vs. Baseline contrast interaction, $F(1,81) = 0.222$, $p = 0.638$, nor the Prime x Attention interaction, $F(4,324) = 1.524$, $p = 0.206$, were significant.

Psychopathy total score

Adding PCL-R total score (z-scored) to the model as a continuous, between-subject factor did not significantly alter any of the within-subject effects found during the manipulation check analysis. Additionally, there was a significant main effect of psychopathy, $F(1,80) = 5.352$, $p = 0.023$, $\eta p2 = 0.063$, such that higher PCL-R total scores were associated with significantly lower ratings across all conditions. PCL-R total scores did not significantly interact with any of the within-subject factors or contrasts, including the main effect of Prime, $F(2,160) = 0.322$, $p = 0.713$, the Distractor-Congruent vs. Target-Congruent contrast, $F(1,80) = 1.329$, $p = 0.252$, and the Distractor-Congruent vs. Baseline contrast $F(1,80) = 0.928$, $p = 0.338$. Based on these results, there was no evidence that either affective priming or inhibitory devaluation significantly changed as a function of psychopathy.

Psychopathy factor scores

All within-subject effects from the manipulation check were preserved when PCL-R Factor 1 scores (z-scored) and PCL-R Factor 2 scores (z-scored) were entered as simultaneous, continuous, between-subject predictors within the model. Neither the main effect of Factor 1, $F(1,77) = 0.276$, $p = 0.601$, nor the main effect of Factor 2, $F(1,77) = 2.743$, $p = 0.102$, were significant. There was, however, a significant Factor 1 x Distractor-Congruent vs. Baseline contrast interaction, $F(1,77) = 4.035$, $p = 0.048$, $\eta p2 = 0.050$, where participants high on PCL-R Factor 1 traits exhibited significantly lower ratings of distractor patterns, relative to baseline ratings.[1] More specifically, those high on PCL-R Factor 1 traits displayed lower ratings for distractor patterns, but higher ratings for baseline patterns, suggesting that individuals high on

[1]Including age as a covariate in this model did not alter this finding, $F(1,76) = 4.056$, $p = 0.048$, $\eta p2 = 0.051$.

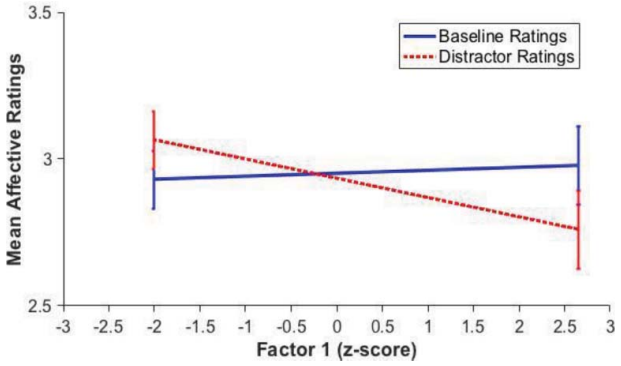

Figure 2. Individuals high on Factor 1 traits showed enhanced inhibitory devaluation. Regression lines represent affective ratings as a function of Factor 1 traits, controlling for Factor 2 traits. Affective ratings from baseline trials (in blue) show that as Factor 1 scores increase, baseline ratings increase ($B = 0.01$, $p = 0.904$). Affective ratings from Distractor-Congruent trials (in red) show that as Factor 1 scores increase, affective ratings of distractors decrease ($B = -0.76$, $p = 0.437$) displayed in red. Factor 1 scores were estimated from Hare's Psychopathy Checklist-Revised (2003) and z-scored. Error bars represent the standard error of the point estimate.

PCL-R Factor 1 traits devalued previously peripheral stimuli to a significantly greater degree than individuals low on Factor 1 traits (i.e., indicating significantly more inhibitory devaluation; see Figure 2). PCL-R Factor 1 scores did not significantly interact with any other within-subject factors or contrasts. PCL-R Factor 2 scores did not significantly interact with any within-subject factors or contrasts.

Discussion

Prior research indicates that individuals with psychopathy and its subcomponent traits show limitations in attending to peripheral information. This attention abnormality leads to context-specific deficits in affective responding during affective tasks (Baskin-Sommers et al., 2011, 2013; Larson et al., 2013; Lorenz & Newman, 2002; Newman & Baskin-Sommers, 2011; Newman, Curtin, Bertsch, & Baskin-Sommers, 2010; Newman & Kosson, 1986; Newman & Lorenz, 2003) or enhanced performance on basic attention, affectively neutral, tasks (Hiatt et al., 2004; Hoppenbrouwers et al., 2015; Wolf et al., 2012; Zeier et al., 2009). The present study found that abnormalities in attention affected how individuals high on Factor 1 traits, but not psychopathy total score or Factor 2 traits, responded to neutral information. Individuals high on Factor 1 traits reported significantly more negative affect in response to previously peripheral, neutral stimuli relative to task-irrelevant stimuli (i.e., greater inhibitory devaluation). More specifically, consistent with prior research showing that individuals high on these traits affectively over-respond to stimuli when affective content is the primary focus of attention (Anderson et al., 2017; Baskin-Sommers et al., 2016), individuals high on Factor 1 traits exhibited descriptively more negative affective ratings for previously distracting visual patterns, and descriptively more positive ratings for task-irrelevant patterns. Combined with previous research, the present finding highlights the importance of attention-related abnormalities for psychopathic traits and identifies another experimental context in which these abnormalities lead to aberrant processing of information.

There is increasing evidence that both the attention abnormalities related to psychopathic traits and the effect of inhibitory devaluation are rooted in neural circuitry critical for allocation of attention (De Vito et al., 2017; Doallo et al., 2012; Kiss et al., 2007; 2008; Larson et al., 2013; Rodman et al., 2016). In the case of inhibitory devaluation, it is believed that recruitment of neural resources to limit attention to peripheral information evokes negative affect, which is then ascribed to the peripheral stimulus, devaluing it (De Vito et al., 2017; Doallo et al., 2012; Frischen et al., 2012; Kiss et al., 2007; 2008; Martiny-Huenger et al., 2014). More specifically, in non-clinical populations, activity in the lateral prefrontal cortex (lPFC), a region of cortex implicated in allocation of attention (Mostofsky & Simmonds, 2008; Tombu et al., 2011) significantly predicts subsequent inhibitory devaluation at the behavioral (i.e., affective ratings) and neural (i.e., amygdala reactivity) levels (Doallo et al., 2012). Interestingly, the lPFC is one of the neural regions that has been linked to attention abnormalities individuals high on psychopathic traits. Individuals high on psychopathic traits display hyperactivation of the lPFC during multiple types of non-affective attention tasks (Rodman et al., 2016). This hyperactivity in the lPFC also correlates with the enhanced performance individuals high on psychopathic traits display on these tasks, suggesting that this over-recruitment of neural resources for attention may be underlying the psychopathy-related abnormalities in behavior (Rodman et al., 2016). Moreover, a similar psychopathy-related hyperactivation of the lPFC has been shown to mediate the context-specific fear conditioning deficits found in individuals high on psychopathic traits (Larson et al., 2013). Although neural activity was not measured in the current study and much of the previous research linking lPFC and psychopathy used a total score, these two lines of research converge to suggest that inhibitory devaluation is related to lPFC activity and that individuals high on psychopathic traits commonly display aberrant lPFC activity. These connections highlight the potential importance of this neural region for the attentional abnormalities present in individuals with psychopathic traits.

Beyond the potential connection among lPFC activity, inhibitory devaluation, and psychopathic traits, the process of limiting attention underlying inhibitory devaluation may be important for understanding the callous and aggressive behaviors commonly displayed by individuals high on Factor 1 traits. As noted above, the effect of inhibitory devaluation is characterized by experiencing negative affect in response to information that is currently, or recently was, peripheral to a goal (De Vito et al., 2017; Doallo et al., 2012; Fenske et al., 2004; 2005; Frischen et al., 2012; Kiss et al., 2007; 2008; Martiny-Huenger et al., 2014; Raymond et al., 2003; 2005). Individuals high on Factor 1 showed an exaggeration of this effect, such that when viewing peripheral neutral cues they responded to those cues with more negative affect than individuals low on these traits. In general, the experience of negative affect is believed to increase risk for engagement in callous and aggressive behaviors (Burt, Mikolajewski, & Larson, 2009; Mammen, Kolko, & Pilkonis, 2002). Given that individuals high on Factor 1 had an exaggerated negative affective response to neutral, peripheral information it is possible that they view non-affective, peripheral information through an affective lens. As a result of interpreting neutral information as negatively valenced, these individuals may be more prone to engage in callous, aggressive behaviors, even when there is no clear affective threat and particularly when actively pursuing another goal (e.g., seeking money, respect, etc.). Although speculative, this elevated risk for callous, aggressive behaviors during goal pursuit, in turn, may contribute to the tendency for individuals high on Factor 1 traits to engage in violent crimes (e.g., assault, rape, murder) and violently recidivate at a higher rate than other offenders (Kiehl & Hoffman, 2011).

Not only may inhibitory devaluation relate to the aggression and violence displayed by individuals with psychopathic traits, but it may also be important for understanding the failure of these individuals to form meaningful interpersonal relationships. Although this study did not examine inhibitory devaluation in a social context, prior work in non-clinical populations has found that inhibitory devaluation also impacts how an individual views neutral, peripheral faces. In this context, the negative affect evoked by limiting attention to peripheral faces leads to those faces being viewed as untrustworthy (Doallo et al., 2012; Fenske et al., 2005 Frischen et al., 2012). Therefore, inhibitory devaluation appears to play a critical role in the evaluation of both peripheral faces (i.e., peripheral people) and peripheral neutral information. It may be that the enhanced inhibitory devaluation displayed by individuals high on Factor 1 traits may results in these individuals viewing people as untrustworthy, particularly when those people are not directly goal-relevant. Although speculative, this frequent devaluation or distrust of people whenever they are goal-irrelevant may explain why individuals high on Factor 1 traits often callously harm others in pursuit of their goals, and fail to maintain long-term interpersonal relationships. Moreover, this type of distrust of others could interfere with effective rehabilitation or treatment of individuals high on Factor 1 traits. Distrust of treatment providers, for example, could impede the ability of a clinician to build rapport with their client, significantly hindering treatment (Leach, 2005), while distrust of police or correctional officers may interfere with effective communication between these individuals, leading to interpersonal conflict.

Unlike the findings for Factor 1 traits, individuals high on psychopathy total score did not show any significant differences in their affective ratings of previously peripheral stimuli (relative to either targets or task-irrelevant stimuli). These findings may indicate that psychopathy, as a unified construct, does not display aberrant inhibitory devaluation. However, this failure to find psychopathy total-score effects may relate to an issue of noncompliance (i.e., a failure to complete the task as instructed). Two behavioral measures were assessed as potential correlates of task noncompliance: reaction time for ratings and overall rating variablity. Noncompliant individuals who were simply attempting to complete the task as quickly as possible would be expected to display significantly faster reaction times for the affective ratings. However, psychopathy total, Factor 1, and Factor 2 scores were not significantly related to reaction time for affective ratings. Noncompliant individuals who may not have attended to the third patterns, but instead simply clicked through to the next trial, would be expected to show less overall variation from the default rating (default rating = 3). The mean rating across the entire sample was higher than 3 (see Table 1) suggesting that on avarage people were thoughtfully considering affective ratings. However, an individual who almost always provided the default rating of three (i.e., potentially noncompliant individuals) would exhibit significantly lower mean ratings of stimuli. All three measures of psychopathy and psychopathic traits were correlated with significantly lower overall rating variablity (see Table 1 for zero-order correlations), indicating that higher levels of psychopathic traits may be associated with higher rates of task noncompliance. The reduced variablity suggests that individuals high on psychopathic traits (Factor 1, Factor 2, and total score) may have been less actively engaged in the affective evaluation component of the task (i.e., they may have not attended

to the third patterns) leading them to rate all the stimuli as the same, default rating (i.e., leading them to rate all stimuli as neutral).

Alternatively, the lower variablity and mean ratings displayed by individuals high on psychopathic traits may reflect a core affective deficit (Blair, Peschardt, Budhani, Mitchell, & Pine, 2006; Benning, Patrick, & Iacono, 2005; Patrick, 2007), in addition to the attention abnormalities established in prior research. Such a deficit in affective responding would blunt these individuals' affective responses to the task stimuli, leading them to view (and rate) all the stimuli as affectively neutral, lowering both rating variablity and mean ratings. However, given the potential impact of task noncompliance on both mean ratings and rating variablity, this issue of task noncompliance limits our ability to interprete the current findings for PCL-R total score. Regardless, neither the issue of noncompliance, nor the issue of a core affective deficit, are likely to have confounded the Factor 1 findings as these results indicate that Factor 1 traits are associated with significantly greater response variablity between experimental conditions.

The present study provides the first evidence that individuals high on Factor 1 traits show exaggerated inhibitory devaluation, meaning that they display context-specific increases in affective responding to affectively neutral stimuli. The current data provide additional support for the idea that Factor 1 traits, which are most associated with the affective deficits in psychopathy (Anderson et al., 2017; Vaidyanathan et al., 2011), may result from dysfunction in attention, rather than a primary affective deficit. Specifying the mechanisms that account for the ways in which individuals high on Factor 1 traits can seem shallow in their affect but respond with strong anger in many situations, can have chronic problems forming meaningful relationships, and can continously engage in acts of callous aggression against others will be crucial for advancing our understanding of the cognitive and neurobiological roots of psychopathy and its subcomponent traits.

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